

Claims

1. Method for determining an EMG-signal out of a raw signal, captured via a number of electrodes, which are designed to be placed in order to detect signals from a diaphragm, and functionally connected to a respective signal channel, characterized in that an EKG-signal and an EMG-signal are estimated out of the raw signal and, depending on the estimated EKG-signal and the estimated EMG-signal, an EMG-window in the frequency region is determined within which the EMG-signal is filtered out.

2. Method according to claim 1, further comprising the step of filtering EMG signal from the determined EMG window.

3. Method according to claim 1 or 2, characterized in that the width of the EMG-window is determined depending on the estimated EKG-signal and the estimated EMG-signal.

4. Method according to one of claims 1-3, characterized in that the EMG-windows lower frequency is determined depending on the estimated EKG-signal and the estimated EMG-signal.

5. Method according to claim 1 or 2, characterized in that the lower frequency of the EMG-signal is determined depending on the estimated EKG signal and that the width of the EMG window is constant.

6. Method according to one of the proceeding claims, wherein the EMG windows upper frequency is determined depending upon the estimated EMG signal and an estimated noise signal.

7. Method according to one of the proceeding claims, characterized in that the EMG window in dependence upon the estimated EKG signal and the estimated EMG signal is divided into two or more sub windows with different filtering criteria.

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8. Method according to one of the proceeding claims, characterized in that the middle frequency of the EMG signal is determined.

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9. Method according to claim 6, characterized in that the middle frequency of the EMG signal is used to monitor/measure muscle fatigue/muscle activity.

10. Method according to claim 9, characterized in that the measured muscle fatigue is used to issue an alarm and/or control a ventilator to provide increased ventilation support.

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11. Method according to claim 8, characterized in that the EMG signal's middle frequency is used to measure the degree of sedation of a patient.

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12. Method according to claim 11, characterized in that the EMG signal's middle frequency is used to regulate the amount of sedative in a ventilator or an anaesthesia machine.

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13. Method according to one of claims 4-12, characterized in that the placement of the EMG window is calculated with use of the slope (derivative) of the EKG curve (26) at the lower border frequency.

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14. Device adapted to filter an EMG signal out of a raw signal, comprising inputs for a number of signal channels for receiving a raw signal and an analysis unit (12) connected to the inputs and designed to filter the raw signal in the signal channels, characterized in that the analysis unit (12) comprises a first estimating unit (36) to

estimate an EKG signal out of a raw signal, a second estimating unit (38) to estimate an EMG signal out of a raw signal, a calculating unit (42) to determine, depending on the estimated EKG signal and the estimated EMG signal, an EMG window in the frequency region, within which the EMG signal is filtered out.

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15. Device according to claim 14, further comprising filter input device 32 to filter an EMG signal out of the raw signal in that EMG window.

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16. Device according to claim 14 or 15, characterized in that the calculating unit (42) is designed to determine the width of the EMG window depending on the estimated EKG signal and the estimated EMG signal.

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17. Device according to claim, 14 or 15, characterized in that the calculation unit (42) is designed to determine the lower frequency of the EMG window depending on the estimated EKG signal and the estimated EMG signal.

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18. Device according to claim 14 or 15, wherein the calculation unit is designed to determine the lower frequency of the EMG window depending on the estimated EKG signal and that the width of the EMG window is constant.

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19. Device according to one of claims 14-18, wherein the calculating unit (42) is designed to determine the upper frequency of the EMG window based on the estimated EKG signal and an estimated noise signal.

20. Device according to one of claims 14-18, characterized in that the calculating unit (42) is designed to divide the EMG window into two or more sub windows with different filtering criteria based on the estimated EKG signal and the estimated EMG signal.

21. Device according to one of claims 14-16, characterized in that the calculating unit (42) is designed to determine the placement of the EMG window using the slope (derivative) of the EKG curve (26) at the lower border frequency.

5 22. Device according to one of claims 14-21, characterized in that it contains input means (38,44) for determining the middle frequency of the EMG signal:

23. Device according to claim 22, further comprising input device for directing, with use of the middle frequency of the EMG signal measurements of muscle fatigue/muscle activity.
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24. Device according to claim 23, arranged to issue an alarm and/or control a ventilator to provide more breathing support using the EMG signal's middle frequency.

15 25. Device according to claim 23, arranged to measure the degree of sedation of a patient using the EMG signal's middle frequency.

26. Device according to claim 25, arranged to regulate the amount of sedative in a ventilator or an anaesthetics machine using said measurements of the degree of sedation of a patient.
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27. A computer program product comprising code which, when it is run in a device (2) adapted to filter an EMG signal out of an raw signal, comprising inputs for a number of signal channels for receiving the raw signal and an analysis unit (12) connected to the inputs and designed to filter the raw signal in the signal channels, allows the analysis unit to perform the following steps:
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- estimate an EKG signal and an EMG signal out of the raw signal
- determine an EMG window in the frequency range which the EMG signal is to be filtered out of based on the estimated EKG signal and the estimated EMG signal.

28. The computer program product according to claim 27, which further allows the analysis unit to

-filter out the EMG signal from the determined EMG window.

5 29. The computer program product according to claim 27 or 28, characterized in that the width of the EMG window is determined based on the estimated EKG signal and the estimated EMG signal.

10 30. The computer program product according to claim 27, 28 or 29, characterized in that the lower frequency of the EMG window is determined based on the estimated EKG signal and the estimated EMG signal.

15 31. The computer program product according to claim 27, 28 or 29, wherein the lower frequency of the EMG window is determined based on the estimated EKG signal and the width of the EMG window is constant.

20 32. The computer program product according to one of claims 27-31, wherein the upper frequency of the EMG window is determined based on the estimated EMG signal and an estimated noise signal.

33. The computer program product according to one of claims 27-32, characterized in that it is arranged to calculate the placement of the EMG window by using the slope (derivative) of the EKG curve at the lower border frequency.

25 34. The computer program product according to any of claims 27-33, characterized in that it is arranged to divide the EMG window into two or more sub windows with different filtering criteria based on the estimated EKG signal and the estimated EMG signal.

35. The computer program product according to one of claims 27-34, characterized in that it is arranged to determine the middle frequency of the EMG signal.

5 36. The computer program product according to claim 35, further arranged to direct, with use of the middle frequency of the EMG signal measurements of muscle fatigue/muscle activity.

10 37. The computer program product according to claim 36, wherein the measured muscle fatigue is used to issue an alarm and/or for controlling a ventilator to give more breathing support

15 38. The computer program product according to claim 35, further arranged to control measurements of the degree of sedation of a patient using the EMG signal's middle frequency.

39. The computer program product according to claim 36, further arranged to regulate the amount of sedative in a ventilator or an anaesthesia machine using the measurements of the degree of sedation.

20 40. The computer program product according to any one of the claims 27-39, arranged on a carrier.